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“Features of Karakoram Glaciers Connected with Pressure, Especially of Affluents.” By WILLIAM H. WORKMAN. *Zeitschrift für Gletscherkunde*, Bd. 8, 1913. Pp. 40, pl. 1.

Great relief, numerous large, high snow-fields, and a series of long, branching valleys reaching down from the uplands furnish the conditions in the Karakoram Mountains for a ramifying system of glaciers that exhibits phenomena lacking in most valley glaciers. The phenomena are chiefly connected with pressure, particularly that developed by affluent glaciers where they press down on their mains. The tremendous force of the tributary glacier, directed essentially at right angles to the direction of movement of the main glacier, forces the latter aside, but the affluent is shortly bent downward and moves parallel to the other glacier. The two glaciers crowd upon one another and are individually somewhat squeezed together, but they remain perfectly distinct, in some instances to a distance of 50 or 60 km. below the point of junction. Of particular interest is the union of the Siachen Glacier (4.4 km. wide, 40 km. long above this junction) and Tarim Shehr (3 km. wide, 25 km. long) which meet at an angle of about 140° . With much structural disturbance and a partial displacement of the main glacier, Tarim Shehr turns through 140° around a small promontory before it moves parallel to the main. Where the valleys are constricted the glaciers are notably narrowed, and the white ice tongues may completely disappear; but the glaciers do not spread to fill the wide parts of the valley.

Where the pressure of affluents on the main glacier is very great, the ice surface, especially along moraine-covered belts, is thrown up into rather irregular-shaped hillocks. Below the juncture of the two ice masses the hillocks become more pronounced, they are covered with piles of discrete débris, and become more or less united in a band parallel to the direction of ice movement; they are then termed “hillock moraines.” Individual hillocks vary from 10 m. to 70 m. (exceptionally 150 m.) in height above the rest of the glacier. The moraine shows no evidence of having been pushed up from below or formed simply by differential melting. Transverse to the direction of pressure, white ice exhibits a series of long parallel ridges. Seracs have developed where there is a steepening of the gradient of the glacier beds, where the ice of Tarim Shehr impinges upon a plowlike promontory, and where constriction of the valley causes longitudinal crevassing. It is concluded that differential melting is an important agent in increasing the height of moraine-covered belts down the glacier. Vertical bands parallel to the direction of movement of the ice are to be noted in all the glaciers;

some vertical sections show extensive folding, faulting, and foliation of the ice strata.

It is concluded that pressure has had a very important rôle in determining variations in the course of the glaciers, surface forms on the glaciers, especially hillock moraines, stratification, and local deformation of the ice, and in the erosion accomplished.

R. C. M.

The Squantum Tillite. By ROBERT W. SAYLES. Bull. of the Museum of Comparative Zoölogy, Harvard College, Vol. LVI, No. 2, Geological series, Vol. X, 1914. Pp. 141-75, pls. 12.

The origin of the Roxbury conglomerate has always been a matter of doubt. It has been held by a number of geologists to be of glacial origin, while yet others have favored its marine derivation.

Robert W. Sayles in the present paper describes a bed of what appears to be tillite in the Roxbury series of Boston and vicinity. The Squantum tillite has a probable thickness of 600 feet and consists of sand, angular, subangular, and rounded pebbles and boulders, and irregular fragments of slate. The size of the fragmental material varies from that of a sand grain to large, angular blocks, one boulder having been found which has a length of 6 feet and a width of 1 foot. Practically all of the material is less than a foot in diameter, with the greater proportion less than 6 inches. All of these fragments are firmly cemented in a matrix of argillite. There are also intercalated beds of slate and conglomerate.

The criteria necessary for the recognition of tillite are enumerated and their application has been made to seventeen outcrops of this apparently glacial material. Mr. Sayles presents strong evidence in favor of the glacial origin of the Squantum tillite. The illustrated boulders and pebbles have a subangular outline and also show fairly distinct striae. A striated bedrock has not been found, but this may be due to the nature of the underlying rocks, which are slates and sandstones.

In one locality the contact with the tillite and underlying sandstone was very ragged, the suggestion being made that the sand deposit, before having been firmly cemented, had been disrupted by violent movements of the ice.

The supposition is made that the movement of the glacier was from the southeast, and that as the advance took place into the Boston basin, the recently deposited beds of sand and clay were torn up and the fragments mingled with the débris of the glacier. The intercalated beds of slate, which become more numerous toward the top of the tillite, are